

WHAT IS CLAIMED IS:

1. A method for selecting frame encoding parameters to improve
5 transmission performance for a transmitting frame being
transmitted from a transmitting station to a receiving station
over a transmission medium of a frame-based communications
network, the transmitting frame having a header segment and a
payload segment, the header segment being transmitted using a
10 fixed set of encoding parameters such that the header segment can
be received and decoded by all stations on the network, the
payload segment being transmitted using a variable set of payload
encoding parameters, the transmitting station sending the
transmitting frame using one set of the variable set of payload
15 encoding parameters at a time, comprising the receiving station:
receiving and decoding the header and payload segments of
each transmitting frame, the decoding including computing frame
statistics;
selecting a plurality of sets from the variable set of
20 payload encoding parameters to form a possible set of payload
encoding parameters;
for each set of payload encoding parameters in the possible
set of payload encoding parameters, generating, based upon the
frame statistics, an estimate of network performance
25 characteristics expected if the transmitting station were to
transmit the transmitting frame using that set of payload
encoding parameters;
selecting, based upon estimates of expected network
performance for each set of payload encoding parameters in the
30 possible set of payload encoding parameters, a set of payload
encoding parameters having optimized network performance
characteristics;
wherein the frame statistics include a slicer maximum
squared error for the header segment and a slicer maximum squared
35 error for the payload segment.

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2. The method of Claim 1, wherein each set of payload encoding
parameters in the possible set of payload encoding parameters is
5 defined by a unique set of a possible symbol rate and a possible
bits per symbol.

3. The method of Claim 1, wherein decoding the header and
payload segments includes using a fractionally spaced equalizer,
10 and wherein the frame statistics include:

a payload segment length;

a payload segment observation length indicating number of
symbols over which the slicer maximum squared error for the
payload segment is computed;

15 an indication of header segment error;

an indication of payload segment error;

an indication of the one set of the variable set of payload
encoding parameters used by the transmitting station for the
transmitting frame;

20 for each unique possible symbol rate in the possible set
of payload encoding parameters, a power of the fractionally
spaced equalizer used to receive and decode the payload segment
if the payload segment had been sent with that possible symbol
rate; and

25 for each unique possible symbol rate in the possible set
of payload encoding parameters, a normalized per-symbol inter-
symbol interference power estimate.

4. The method of Claim 1, wherein the expected network
30 performance characteristics include an expected system throughput
and an expected packet error rate.

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5. The method of Claim 1, wherein the optimized network performance characteristics include a maximum expected system throughput with the expected packet error rate at or below a predetermined packet error rate.

6. The method of Claim 5, wherein the maximum system throughput is further constrained to be at least a predetermined percentage greater than the expected system throughput for a set of payload encoding parameters selected most recently, and if no member of the possible set of payload encoding parameters pass such constraint, the maximum system throughput is defined to be expected system throughput of the set of payload encoding parameters selected most recently.

7. The method of Claim 4, wherein the expected system throughput is defined as the product of the possible symbol rate and the possible bits per symbol.

8. The method of Claim 4, wherein the expected system throughput is defined as an average payload segment length divided by an expected time of the transmitting frame on the transmission medium, the expected time of the transmitting frame on the transmission medium being calculated as a function of an average payload segment length for a plurality of received frames, the possible symbol rate, the possible bits per symbol, a time on the transmission medium for the header segment, a collision resolution algorithm overhead value, and an expected number of retransmissions, the expected number of retransmissions being calculated as a function of the expected packet error rate.

9. The method of Claim 4, wherein the expected packet error rate is computed by:
computing an average length-independent error rate estimate;

computing an average length-dependent error rate estimate;
computing an average observation length estimate
5 corresponding to the average length-dependent error rate
estimate, based on the payload segment observation length;

computing an average payload segment length, based on the
payload segment length; and

10 computing the expected packet error rate as a function of
the average length-independent error rate estimate, the average
length-dependent error rate estimate, the average observation
length estimate, the average payload segment length, and the
possible bits per symbol.

15 10. The method of Claim 9, wherein computing an average includes
calculating a weighted average for a predetermined number of
received frames.

20 11. The method of Claim 10, wherein calculating a weighted
average includes applying a weighting function based upon number
of symbols in a received frame, order of frame reception, and
time of frame reception.

25 12. The method of Claim 9, wherein the average length-
independent error rate estimate is a function of:

the slicer maximum squared error for the header segment;

the possible bits per symbol;

the power of the fractionally spaced equalizer used for
decoding the header segment;

30 the normalized per-symbol inter-symbol interference power
estimate for the header segment;

the power of the fractionally spaced equalizer for the
possible symbol rate; and

35 the normalized per-symbol inter-symbol interference power
estimate for the possible symbol rate.

13. The method of Claim 9, wherein the average length-dependent error rate estimate is a function of:

- 5 the slicer maximum squared error for the header segment;
- the slicer maximum squared error for the payload segment;
- the possible bits per symbol;
- the power of the fractionally spaced equalizer for the symbol rate used by the transmitting station for the transmitting
- 10 frame;
- the normalized per-symbol inter-symbol interference power estimate for the symbol rate used by the transmitting station for the transmitting frame;
- the power of the fractionally spaced equalizer for the
- 15 possible symbol rate;
- the normalized per-symbol inter-symbol interference power estimate for the possible symbol rate; and
- the indication of payload segment error.

- 20 14. A method for selecting frame encoding parameters to improve transmission performance for a transmitting frame being transmitted from a transmitting station to a receiving station over a transmission medium of a frame-based communications network, the transmitting frame having a header segment and a
- 25 payload segment, the header segment being transmitted using a fixed set of encoding parameters such that the header segment can be received and decoded by all stations on the network, the payload segment being transmitted using a variable set of payload encoding parameters, the transmitting station sending the
- 30 transmitting frame using one set of the variable set of payload encoding parameters at a time, comprising the receiving station:
 - receiving and decoding the header and payload segments of each transmitting frame, the decoding including computing frame statistics;
- 35 selecting a plurality of sets from the variable set of

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payload encoding parameters to form a possible set of payload encoding parameters;

5 for each set of payload encoding parameters in the possible set of payload encoding parameters, generating, based upon the frame statistics, an estimate of network performance characteristics expected if the transmitting station were to transmit the transmitting frame using that set of payload
10 encoding parameters;

selecting, based upon the estimates of expected network performance for each set of payload encoding parameters in the possible set of payload encoding parameters, a set of payload encoding parameters having optimized network performance
15 characteristics;

wherein the expected network performance characteristic estimates include expected time of the transmitting frame on the transmission medium, and the optimized network performance characteristics include minimum time of the transmitting frame
20 on the transmission medium; and

wherein the expected time of the transmitting frame on the transmission medium is calculated as a function of an average number of payload bytes, a payload symbol rate, a payload bits per symbol, a header segment time on the transmission medium, a
25 collision resolution overhead time, and an expected number of retransmissions, the expected number of retransmissions being calculated as a function of an estimated packet error rate.

15. The method of Claim 14, wherein the estimated packet error
30 rate is generated by:

computing a mean square error estimate as a weighted average of a slicer sum of squared error for the header segment and a slicer sum of squared error for the payload segment;

rescaling the mean squared error for a symbol rate of
35 interest to provide a rescaled error; and

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comparing the rescaled error to a threshold for a symbol constellation of interest.

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16. The method of claim 15, wherein the threshold is weighted by the results of previous threshold comparisons.

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